

CLAIMS

1. A transgenic plant cell transformed by a Oxidoreductase Stress-Related Protein (ORSRP) coding nucleic acid, wherein expression of said nucleic acid in the plant cell results in increased tolerance to an environmental stress as compared to a corresponding non-transformed wild type plant cell.
2. The transgenic plant cell of claim 1, wherein the ORSRP is heat-stable.
3. The transgenic plant cell of claim 1 or 2, wherein the ORSRP is selected from yeast or plants.
4. The transgenic plant cell of claims 1 – 3, wherein the ORSRP is selected from the group comprising glutaredoxin and/or thioredoxin protein.
5. The transgenic plant cell of claims 1 – 4, wherein the ORSRP coding nucleic acid is selected from the group comprising SEQ ID No. 1, 3, 5, 7, 9, 11, 13 of yeast and/or SEQ ID No. 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49 of plants and/or homologs thereof.
6. The transgenic plant cell of claims 1 – 5, wherein the ORSRP coding nucleic acid is at least about 50 % homologous to SEQ ID No. 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49.

7. The transgenic plant cell of claims 1 – 6, wherein the environmental stress is selected from the group consisting of salinity, drought, temperature, metal, chemical, pathogenic and oxidative stresses, or combinations thereof.
8. The transgenic plant cell of claims 1 – 7 derived from a monocotyledonous plant.
9. The transgenic plant cell of claims 1 – 7 derived from a dicotyledonous plant.
10. The transgenic plant cell of claims 1 – 9, wherein the plant is selected from the group consisting of maize, wheat, rye, oat, triticale, rice, barley, soybean, peanut, cotton, rapeseed, canola, manihot, pepper, sunflower, borage, sunflower, linseed, primrose, rapeseed, turnip rape, tagetes, solanaceous plants, potato, tobacco, eggplant, tomato, Vicia species, pea, alfalfa, coffee, cacao, tea, Salix species, oil palm, coconut, perennial grass, forage crops and Arabidopsis thaliana.
11. The transgenic plant cell of claims 1 – 7, derived from a gymnosperm plant.
12. The transgenic plant cell of claims 1 – 7 or 11, wherein the plant is selected from the group of spruce, pine and fir.
13. A transgenic plant generated from a plant cell according to claims 1 – 10 and which is a monocot or dicot plant.

14. A transgenic plant of claim 13, which is selected from the group consisting of maize, wheat, rye, oat, triticale, rice, barley, soybean, peanut, cotton, rapeseed, canola, manihot, pepper, sunflower, borage, sufflower, linseed, primrose, rapeseed, turnip rape, tagetes, solanaceous plants, potato, tobacco, eggplant, tomato, Vicia species, pea, alfalfa, coffee, cacao, tea, Salix species, oil palm, coconut, perennial grass, forage crops and Arabidopsis thaliana.
15. A transgenic plant generated from a plant cell according to claims 1 – 7, 11 or 12 and which is a gymnosperm plant.
16. A transgenic plant of claim 15, which is selected from the group consisting of spruce, pine and fir.
17. A seed produced by a transgenic plant of claim 13 - 16, wherein the seed is genetically homozygous for a transgene conferring an increased tolerance to environmental stress as compared to a wild type plant.
18. A plant expression cassette comprising a ORSRP coding nucleic acid selected of a group comprising SEQ ID No. 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49 or parts thereof operatively linked to regulatory sequences and/or targeting sequences.
19. An expression vector comprising a ORSRP encoding nucleic acid selected of a group comprising SEQ ID No. 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49 or parts thereof or a plant expression cassette of claim 18, whereby expression

of the ORSRP coding nucleic acid in a host cell results in increased tolerance to environmental stress as compared to a wild type host cell.

20. An expression vector comprising a ORSRP coding nucleic acid selected of a group comprising SEQ ID No. 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49 or parts thereof in an antisense orientation.
21. An isolated Oxidoreductase Stress Related Protein (ORSRP) which is selected from the group comprising SEQ ID No. 16, 18, 20, 22, 24, 44 and 50.
22. An isolated Oxidoreductase Stress Related Protein (ORSRP) of claim 17 which is heat-stable.
23. An isolated Oxidoreductase Stress Related Protein (ORSRP) of claims 21 or 22 which is selected from plant.
24. An isolated Oxidoreductase Stress Related Protein (ORSRP) of claim 21-23 wherein the ORSRP is a glutaredoxin or thioredoxin protein.
25. An isolated Oxidoreductase Stress Related Protein (ORSRP) encoding nucleic acid selected from the group comprising SEQ ID No. 15, 17, 19, 21, 23, 45 and 49.
26. An isolated Oxidoreductase Stress Related Protein (ORSRP) encoding nucleic acid of claim 25 encoding an ORSRP which is heat-stable.

27. An isolated Oxidoreductase Stress Related Protein (ORSRP) encoding nucleic acid of claims 25 or 26 encoding an ORSRP which is selected from plants.
28. An isolated Oxidoreductase Stress Related Protein (ORSRP) encoding nucleic acid of claims 25-27 wherein the ORSRP is a glutaredoxin or thioredoxin .
29. A method of producing a transgenic plant comprising an ORSRP coding nucleic acid, wherein expression of the nucleic acid in the transgenic plant results in increased tolerance to environmental stress as compared to a corresponding non-transformed wild type plant, comprising
 - a) transforming a plant cell with an expression vector comprising the nucleic acid,
 - b) generating from the plant cell a transgenic plant with an increased tolerance to environmental stress as compared to a corresponding wild type plant.
30. The method of claim 29, wherein the used ORSRP is heat-stable.
31. The method of claims 29 or 30, wherein the ORSRP is a glutaredoxin or thioredoxin protein.
32. The method of claims 29-31, wherein the ORSRP coding nucleic acid is selected from the group comprising SEQ ID No. 1, 3, 5, 7, 9, 11, 13 of yeast and/or SEQ ID No. 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49 of plants and/or homologs thereof.

33. The method of claims 29-32, wherein the ORSRP coding nucleic acid is at least about 50% homologous to SEQ ID No. 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49.
34. A method of modifying stress tolerance of a plant comprising, modifying the level of expression of an ORSRP in the plant.
35. The method of claim 34, wherein the ORSRP is heat-stable.
36. The method of claims 34 or 35, wherein the ORSRP is a glutaredoxin or thioredoxin protein.
37. The method of claims 34 – 36, wherein the ORSRP encoding nucleic acid is selected from the group comprising SEQ ID No. 1, 3, 5, 7, 9, 11, 13 of yeast and/or SEQ ID No. 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49 of plants and/or homologs thereof.
38. The method of claims 34 – 37, wherein the ORSRP coding nucleic acid is at least about 50% homologous to SEQ ID No. SEQ ID No. 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49.
39. The method of claims 34 – 38, wherein an expression vector is used according to claims 19 or 20.
40. The method of claims 34 – 39, wherein the stress tolerance is decreased.
41. The method of claims 34 – 40, wherein the plant is transgenic.

42. The method of claims 34 – 41, wherein the plant is transformed with an inducible promoter that directs expression of the ORSRP.
43. The method of claims 34 – 42, wherein the promoter is tissue specific.
44. The method of claims 34 – 43, wherein the promoter is developmentally regulated.
45. The method of claims 34 – 44, wherein ORSRP expression is modified by administration of an antisense molecule and/or by double stranded RNA interference that inhibits expression of ORSPR.
46. The method of claims 34 – 45, wherein ORSRP expression is modified by administration of an targeting nucleic sequence complementary to the regulatory region of the ORSRP encoding nucleic acid and/or by a transcription factor and/or by a zinc finger protein.
47. Use of ORSRP encoding nucleic acid selected from the group comprising SEQ ID No. 1, 3, 5, 7, 9, 11, 13 of yeast and/or SEQ ID No. 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49 of plants and/or homologs thereof for preparing a plant cell with increased environmental stress tolerance.
48. Use of ORSRP encoding nucleic acid selected from the group comprising SEQ ID No. 1, 3, 5, 7, 9, 11, 13 of yeast and/or SEQ ID No. 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49 of plants and/or homologs thereof for preparing a plant with increased environmental stress tolerance.

49. Use of ORSRP encoding nucleic acid selected from the group comprising SEQ ID No. 1, 3, 5, 7, 9, 11, 13 of yeast and/or SEQ ID No. 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49 of plants and/or homologs thereof or parts thereof as DNA markers for selection of plants with increased tolerance to environmental stress.
50. Use of ORSRP encoding nucleic acid selected from the group comprising of SEQ ID No. 1, 3, 5, 7, 9, 11, 13 of yeast and/or SEQ ID No. 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49 of plants and/or homologs thereof or parts thereof as Quantitative Trait Locus (QTL) markers for mapping genetic loci associated with environmental stress tolerance.